Astronomy and Astrophysics 2003 vol.401 N3, pages 1009-1015

High efficiency of soft X-ray radiation reprocessing in supersoft X-ray sources due to multiple scattering

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Abstract

Detailed analysis of the lightcurve of CAL 87 clearly has shown that the high optical luminosity comes from the accretion disc rim and can only be explained by a severe thickening of the disc rim near the location where the accretion stream impinges. This area is irradiated by the X-rays where it faces the white dwarf. Only if the reprocessing rate of X-rays to optical light is high a luminosity as high as observed can be understood. But a recent detailed study of the soft X-ray radiation reprocessing in supersoft X-ray sources has shown that the efficiency is not high enough. We here propose a solution for this problem. As already discussed in the earlier lightcurve analysis the impact of the accretion stream at the outer disc rim produces a "spray", consisting of a large number of individual gas blobs imbedded in a surrounding corona. For the high mass flow rate this constitutes an optically thick vertically extended screen at the rim of the accretion disc. We analyse the optical properties of this irradiated spray and find that the multiple scattering between these gas blobs leads to an effective reprocessing of soft X-rays to optical light as required by the observations.

Keywords

Accretion, accretion disks, Radiative transfer, Scattering, Stars: circumstellar matter, Stars: novae, cataclysmic variables, X-rays: stars